VIRGINIA DEPARTMENT OF ENVIRONMENTAL QUALITY
WASTE DIVISION
OFFICE OF WASTE PERMTTING

PERMITTING GUIDANCE FOR LOCATING NEW WASTE UNITS OVER EXISTING CLOSED WASTE UNITS ("PIGGYBACKING") AT LANDFILLS

The procedures set forth in this document are intended solely for the guidance of solid waste permit writers at the Department of Environmental Quality (Department). They are not intended to, nor do they constitute rulemaking by the Department. They may not be relied upon to create a right or benefit, substantive or procedural, enforceable at law or in equity, by any person. Whether and how the Department applies these procedures in any given case will depend on the facts of the case.

The following factors will be considered by the Department for applications involving the piggybacking of landfill units:

- Total settlement of the existing landfill.
- Slopes of the leachate collection and liner system on the interface [old unit-new unit] slope must account for settlement of the liner.
- Differential settlements within the existing landfill.
- Waste placement in the new landfill must be care fully sequenced to balance stress on the exiting landfill. The stability of the waste situation is compromised by the large surcharge stress created by the new landfill unit being placed over the old waste mass.
- Methane Gas migrating from the old unit must be carried away from the liner for the new unit. Active gas control may be required.
- Leachate collection in the existing unit, if applicable, will have to be significantly modified.
- Access to the site via haul roads must not cause damage to, or instability of the existing liner system or cap.

Using existing waste as a foundation or base for a new waste unit will be considered a site defect for siting the new waste unit. Due to the instability associated with piggybacking over waste slopes of less than 20%, the existing waste must be removed and structural fill placed in these areas. Piggybacking over waste slopes between 20 and 30% is a site defect that can be mitigated, because the engineering, construction and monitoring of the new unit has been recognized by a number of States. Using soil as fill over a waste area to achieve a steeper grade does not eliminate the defect. Site specific information on geophysics of voids, load testing and FEM analysis could be a substitute for a failed site defect. Piggyback designs must isolate the upper new unit from the

existing lower unit in terms of unit leakage. The default for this requirement is a textured double FML liner separated by a geonet witness zone.

A permit application that involves piggybacking over slopes of less than 20% must address Code of Virginia, 10.1-1400, et al as appropriate and 9 VAC 20-80- 500.C, Issuance of a new permit is required when there is:

1. Any new solid waste management facility; or

2. Any change in design or process of a solid waste management facility that will, in the opinion of the director, result in a substantially different type of facility.

A permit application that involves piggy backing over slopes between 20 and 30% is an "expansion" and must address 9 VAC 20-80-500.A.and B., 9 VAC 620, E. and G, or F and G; Amendments of Permits. If the expansion area is identified and located in a Part A application that has been approved by the Department; a directors determination in accordance with the Code of Virginia, 10.1-1408.D, will not be required.

Attached is guidance from the Regulations and the Submission Instructions.

ATTACHMENT 1

The **Virginia Solid Waste Management Regulations** address the piggybacking issue in accordance to 9 VAC 20-80 as follows:

Sanitary Landfills

PART A - TECHNICAL ISSUES

All sections of 9 VAC 20-80-250 apply and the following specific sections pertain to the issues of liner foundations and existing waste.

250.A.3. Unstable Areas.

a. Owners or operators of all sanitary landfills located in an unstable area shall demonstrate that engineering measures have been incorporated into the facility's design to ensure that the integrity of the structural components of the facility will not be disrupted. He shall consider the following factors, at a minimum, when determining whether an area is unstable:

(3) On-site or local man-made features or events (both surface and subsurface) that may result in sudden or non-sudden events and subsequent failure of structural components.

250.A.6. Seismic impact zones. New sanitary landfills and lateral expansions of existing facilities shall not be located in seismic impact zones, unless the

owner or operator demonstrates to the director that all containment structures, including liners, leachate collection systems, and surface water control systems, are designed to resist the maximum horizontal acceleration in lithified earth material for the site.

PART B – TECHNICAL ISSUES

250.B.9. All sanitary landfills shall be underlain by a composite liner system as follows:

a. Base preparation to protect the liner by preventing liner failure through subsidence or structural failure of the liner system.

CDD landfills

All sections of 9 VAC 20-80-260 apply and the following specific sections pertain to the issues of liner foundations and existing waste.

PART A - TECHNICAL ISSUES

260.A. 2. CDD landfills shall not be sited in geologically unstable areas where inadequate foundation support for the structural components of the landfill exists. Factors to be considered when determining unstable areas shall include:

c. Man-made features or events (both surface and subsurface) that may result in sudden or non-sudden events and subsequent failure of containment structures;

PART B – TECHNICAL ISSUES

B.2. CDD landfills shall not be sited in geologically unstable areas where inadequate foundation support for the structural components of the landfill exists. Factors to be considered when determining unstable areas shall include:

c. Man-made features or events (both surface and subsurface) that may result in sudden or non-sudden events and subsequent failure of containment structures;

Industrial landfills

All sections of 9 VAC 20-80-270 apply and the following specific sections pertain to the issues of liner foundations and existing waste

270.A.2. Landfills shall not be sited in geologically unstable areas where inadequate foundation support for the structural components of the landfill exists. Factors to be considered when determining unstable areas shall include:

c. Man-made features or events (both surface and subsurface) that may result in sudden or non-sudden events and subsequent failure of containment structures;

ATTACHMENT 2

The companion document to the Regulations are the **Submission Instructions**. The applicable section of the submission instructions are as follows:

Part A Issues

1. Unstable Areas [9 VAC 20-80-250.A.3., 260.A.2., 270.A.2., or 330.B.2., 9 VAC 20-80-10 et seq, Code of Virginia Section 10.1-1408.3.B.5].
   The application shall include a detailed geotechnical and geological evaluation designed to assess the subsurface under natural and human-induced conditions. The assessment of whether the subsurface can support the unit adequately without damage to the structural components shall address:

   - Poor foundation conditions that may result in inadequate support for structural components of the unit such as old fill areas, expansive soils and soils subject to rapid settlement;

   - Areas susceptible to mass movement where down slope movement of soil, rock, (alone or mixed with water) and/or debris can occur under the influence of gravity; or

   - Areas underlain by soluble bedrock, that have the potential to develop karst terrain. These areas may contain extensive subterranean drainage systems and relatively large subsurface voids that can lead to sinkhole development.

     If the assessment shows that the proposed unit will be located in an unstable area, the applicant may choose to provide assurances that engineering measures will be incorporated into the design of the unit to ensure that the integrity of the structural components of the unit will not be disrupted.

2. Seismic Impact Zones [9 VAC 20-80-250.A.6., 9 VAC 20-80-10 et seq].
   The regulations prohibit siting of new sanitary landfill units or lateral expansions in a seismic impact zone unless the owner or operator can demonstrate that the structural components of the unit are designed to resist the maximum horizontal acceleration in the lithified earth material for the site.

Existing units are not required to be retrofitted. To determine whether the unit is located in the seismic impact zone, the applicant, at a minimum, should review the USGS seismic impact zone, seismic 250-year interval maps. For areas not covered by Algermissen et al, USGS state seismicity maps may be used to estimate the maximum horizontal acceleration. The National Earthquake Information Center, located at the Colorado School of Mines in Golden, Colorado can provide seismicity maps of all 50 states. The center also maintains a database of known earthquakes and fault zones. If the maximum horizontal acceleration is less than or equal to 0.1 g, then the design of the unit will not have to incorporate an evaluation of seismic effects under these rules. If a sanitary landfill is located in a seismic impact zone, then the applicant shall include a demonstration that the design of the unit's structural components (e.g., liners, leachate collection, final covers, run-on and runoff systems) will resist the maximum horizontal acceleration in lithified materials at the site. The demonstration and the design requirements are shown in Submission Instruction No. 15.

Part B Issues

1. Liner Foundation.

a. Design Description**.** Describe the liner foundation design and materials of construction. Determine the capability of the foundation to support any expected static and dynamic loadings.

b. Subsurface Exploration Data**.** The engineering characteristics of the foundation materials should be verified through subsurface explorations. These efforts should be described and may include:

- Test borings or standard penetration tests;
- Test pits or trenches;
- In-situ tests such as vane shear tests; and
- Geophysical exploration methods.

c. Location Relative to High Water Table**.** Provide data showing fluctuations in the depth to the water table and the location of the seasonal high water table in relation to the liner system.

d. Laboratory Data**.** Results from sufficient index testing should be provided to classify the site materials. Other lab test data should be provided to evaluate the engineering properties of the foundation materials, particularly for strength, hydraulic conductivity, compressibility, and other important design parameters.

e. Engineering Analyses**.** Engineering analyses should be provided which are based on the data gathered through subsurface exploration and laboratory testing programs:

(1) Settlement Potential**.** Provide estimates of total and differential settlement, including immediate settlement, and primary and secondary consolidation. Stresses imposed by liners, wastes and equipment should be considered.

(2) Bearing Capacity and Stability**.** Provide estimates of the bearing capacity and stability of foundation, demonstrating that allowable bearing capacity will not be exceeded.

(3) Bottom Heave or Blow-out**.** Provide estimates of the potential for bottom heave or blow-out due to unequal hydrostatic or gas pressures.

(4) Construction and Operational Loading**.** Demonstrate that the foundation is capable of providing adequate support for construction and operating equipment.

f. Installation Procedures**.** For installed foundations, provide a description of the foundation installation procedures.

g. Liner Bedding**.** For synthetic liners, demonstrate that sufficient bedding will be provided above and below the liner to prevent rupture during installation and operation.

h. Installation Inspections. Describe the inspection, monitoring, sampling and testing methods and frequencies to be employed during foundation installation to assure that the foundation as installed meets the design requirements.